

Claims

1. A method of determining a performance of plasma etch equipment, comprising the steps of

5 - etching a semiconductor wafer using the plasma etch equipment,

10 - extracting data that depend on the performance of plasma etch equipment, during etching of the semiconductor wafer,

15 - comparing the extracted data with predetermined data, and

20 - deciding whether the performance of the plasma etch equipment is acceptable, on the basis of a result of comparing the extracted data with predetermined data.

25 2. The method according to claim 1, wherein the step of extracting data comprises calculating an etch rate.

30 3. The method according to claim 1, wherein the step of extracting data comprises calculating a non-uniformity of an etched surface.

35 4. The method according to claim 2, wherein the etch rate is calculated from interferometric endpoint (IEP) signals.

40 5. The method according to claim 2, wherein the etch rate is calculated from optical emission spectroscopy (OES) signals.

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6. The method according to claim 3, wherein the non-uniformity is calculated from optical emission spectroscopy (OES) signals.

5 7. The method according to claim 4, wherein the etch rate ER in nm/min is calculated according to the formula

$$ER = \frac{D \cdot N_p \cdot 60}{t_2 - t_1}$$

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wherein

- D is the thickness of a film being etched in nm,

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- N_p is the number of periods between the times t_1 and t_2 (in sec) and

wherein D is calculated according to the formula

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$$D = \frac{\lambda}{2 \cdot IR}$$

wherein

25 - λ is a laser wavelength used for producing IEP signals and

- IR is the index of refraction of the film being etched.

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8. The method according to claim 5, wherein the etch rate ER in nm/min is calculated according to the formula

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$$ER = \frac{D \cdot 60}{(t_1 + t_2)/2}$$

wherein

- D is the thickness of a film being etched in nm,

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- t_1 is an endpoint start time in sec and

- t_2 is an endpoint end time in sec.

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9. The method according to claim 1, wherein the predetermined data comprise of stored historical data.

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10. The method according to claim 1, wherein the predetermined data comprise of statistical process control (SPC) data.

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11. The method according to claim 6, wherein the non-uniformity U is calculated according to the formula

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$$U = \frac{t_2 - t_1}{t_2 - t_0} \times 100$$

wherein

- t_0 is an etching start time,

10 - t_1 is an endpoint start time and

 - t_2 is an endpoint end time.

15 12. A method of determining a performance of plasma etch equipment, comprising the steps of

 - providing a substrate having a film to be etched,

20 - etching the film using the plasma etch equipment,

 - calculating an etch rate of the film during etching of the film,

25 - calculating a non-uniformity of the film during etching of the film,

 - comparing the calculated data with predetermined data, and

30 - deciding whether the performance of the plasma etch equipment is acceptable, on the basis of a result of comparing the calculated data with predetermined data.

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13. The method according to claim 12, wherein the etch rate is calculated from interferometric endpoint (IEP) signals.

5 14. The method according to claim 12, wherein the etch rate is calculated from optical emission spectroscopy (OES) signals.

10 15. The method according to claim 12, wherein the non-uniformity is calculated from optical emission spectroscopy (OES) signals.

15 16. A system for determining a performance of plasma etch equipment, comprising

- means for extracting data that depend on the performance of plasma etch equipment, during an etch operation,

20 - means for comparing the extracted data with predetermined data, and

25 - means for deciding whether the performance of the plasma etch equipment is acceptable, on the basis of a result of comparing the extracted data with predetermined data.

17. The system according to claim 16, wherein the means for extracting data comprise means for calculating an etch rate.

30 18. The system according to claim 16, wherein the means for extracting data comprise means for calculating a non-uniformity of an etched surface.

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19. The system according to claim 17, wherein means for calculating the etch rate from interferometric endpoint (IEP) signals are provided.

5 20. The system according to claim 17, wherein means for calculating the etch rate from optical emission spectroscopy (OES) signals are provided.

10 21. The system according to claim 18, wherein means for calculating the non-uniformity from optical emission spectroscopy (OES) signals are provided.

15 22. A system for determining a performance of plasma etch equipment, comprising

- means for calculating an etch rate during an etch operation,

- means for calculating a non-uniformity of a film being etched during the etch operation,

20 - means for comparing the calculated data with predetermined data, and

25 - means for deciding whether the performance of the plasma etch equipment is acceptable, on the basis of a result of comparing the calculated data with predetermined data.